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THE SYNONYMY AND SYSTEMATICS OF A GENUS AND TWO SPECIES OF NEW ZEALAND WETA (ORTHOPTERA : STENOPELMATIDAE : HENICINAE)[1]

By Graeme W. Ramsay

(Zoology Department, Victoria University of Wellington)[2]

I have recently had access to the type specimens of two species of New Zealand weta, *Onosandrus lanceolatus* (Walker) and *Deinacridopsis connectens* Ander, neither of which is included in the *Revision of New Zealand Wetas* of Salmon (1950). This has provided an opportunity to bring their classification and synonymy up to date, and to describe the variation which occurs within *D. connectens*.

Hemiandrus lanceolatus (Walker, 1869)

Ceuthophilus (?) *lanceolatus* Walker, 1869 : 204, No. 16.
Libanasa pallitarsis Walker, 1871 : 24.
Ceuthophilus (?) *lanceolatus* Walker, Hutton, 1881 : 84.
Libanasa pallitarsis Walker, Hutton, 1881 : 88.
Onosandrus pallitarsis (Walker), Hutton, 1897 : 221.
Onosandrus pallitarsis (Walker), Alfken, 1903 : 588.
Onosandrus (?) *lanceolatus* (Walker), Kirby, 1906 : 121.
Onosandrus lanceolatus (Walker), Karny, 1937 : 207.

Walker (1869) described this species from a single immature female specimen, doubtfully including it in the genus *Ceuthophilus* Scudder, 1862. Kirby (1906), who had Walker's type specimens available, questionably placed this species in the genus *Onosandrus* Stål, 1876, simultaneously synonymising with it *Libanasa pallitarsis* Walker, 1871, a species already placed in the genus *Onosandrus* by Hutton (1897). *H. lanceolatus* was doubtfully made a synonym of *Macropathus edwardsii* (Scudder)[3] by Hutton (1897 : 240). Karny (1937) followed Kirby (1906), but did not question the generic placing of the species. Salmon (1950) regards *Libanasa pallitarsis* Walker, 1871, as a synonym of *Zealandosandrus maculifrons* (Walker, 1869).

The type specimen of the species *Ceuthophilus* (?) *lanceolatus* is a female nymph possessing characteristically juvenile short, thick and blunt ovipositor blades. The specimen is at least half-grown and has the following characters of the genus *Hemiandrus* Ander, 1938 :

(i) Extremely short ovipositor equal to only one third of the length of the pronotum ; a longer ovipositor should be present if the specimen belonged to the similar genus *Zealandosandrus* Salmon, 1950.

(ii) All the tibiae are rounded above, armed with spines above and below, and possess two pairs of distal spines, one inferior and the other superior.

(iii) Each hind tibia has a pair of small sub-apical spines and a pair of long sub-apical superior spurs.

Its characteristics are in general agreement with the generic diagnosis of Salmon (1950 : 169–70).

[1] Work carried out during the tenure of a New Zealand University Research Fellowship.

[2] Now of the Entomology Division, D.S.I.R., stationed at the Dominion Physical Laboratory, Private Bag, Lower Hutt, New Zealand.

[3] This species, later placed in the genus *Pleioplectron* by Hutton (1899), is now regarded as a synonym of *Macropathus filifer* Walker, 1869 (*see* Richards, 1958 : 466).

The specimen which is labelled " Type ", " N. Zealand ", and " *Ceuthophilus* (?) *lanceolatus* W. *type* ", is recorded by Walker (1869 : 204) as having been collected by H. Drew Esq. Drew informed Walker that " these insects were found in caves, half a mile within ". Wetas of the genus *Hemiandrus* are not known to live in caves, and usually form burrows, six inches or more in length, in the ground. Three new species of cave weta (*Macropathus*) are described by Walker in the succeeding four pages of his 1869 *Catalogue*, and each carries exactly the same locality and collection data as the specimen of *Hemiandrus lanceolatus*. It is possible that Drew inadvertently placed this single specimen amongst a collection of cave wetas, thereby causing it to be doubtfully regarded as a member of a rhaphidophorid genus. If he failed to label the specimen individually it would naturally be assumed to have the same locality and habitat data as the associated cave wetas. This association may also have prompted Hutton (1897) into making it a synonym of the cave weta *Macropathus edwardsii*.

Four New Zealand species of *Hemiandrus* have been described since Walker's *Catalogue* was published, and of these one may be conspecific with *H. lanceolatus*. *H. monstrosa* Salmon, known only from the North Auckland peninsula, possesses characteristic mandibular outgrowths, and may be safely omitted from consideration, as such outgrowths are entirely lacking in *H. lanceolatus*, which probably came from the Wanganui area where Drew did most of his collecting. Adult females of the remaining three species, *H. furcifer* Ander, *H. similis* Ander and *H. anomalis* Salmon, can be distinguished from each other by the shape and degree of development of the sternal appendage of the abdomen. The morphology of their nymphs is unknown, so that *H. lanceolatus* (in which no sign of an abdominal appendage had appeared) cannot be referred to any one of them with certainty. The complete absence of a sternal appendage suggests that it may be conspecific with *H. anomalis*, but for the present it is best regarded as a *species inquirenda*.

The type specimen is in the British Museum (Natural History), London.

Deinacrida White, 1842

Deinacrida White, 1842 : 78.
Deinacrida White, Karny, 1937 : 221–2.
Deinacridopsis Ander, 1939 : 292, **syn. nov.**.
Deinacrida White, Salmon, 1950 : 123.
Deinacrida White, Salmon, 1955 : 21.
Deinacridopsis Ander, Salmon, 1955 : 21.

In 1939 Ander established the monotypic genus, *Deinacridopsis*, for two specimens of a new species of New Zealand weta, which he named *Deinacridopsis connectens*. Almost every character of *Deinacridopsis* is also present is *Deinacrida*. Salmon (1955) separates the two genera by the structure of the prosternum which has " two sharp spines or spine-like lobes " in *Deinacrida* and " two rounded protuberances " in *Deinacridopsis*. Ander (1939) describes the prosternal protuberances of *Deinacridopsis* as " 2 etwa tetraeförmigen Höcken " (two nearly tetrahedral protuberances), while the corresponding structures of *Deinacrida* have been described as " sharp spines " (Salmon, 1950 : 123). However, when specimens of the type species of the two genera are compared, the prosternal protuberances are seen to be the same in all cases. They may perhaps be best described as two sharp, approximately pyramid-shaped spines.

Three other differences emerge from a comparison of descriptions of the two genera. The femora of the legs of *Deinacrida* are " rounded above and grooved below with lateral carinae ". Such are absent beneath the first two pairs of femora of the specimens of *Deinacridopsis* which are rounded above and below. Specimens of *Deinacrida sonitospina* Salmon also sometimes lack the grooves and lateral carinae. Both specimens of *Deinacridopsis connectens* are preserved in alcohol and so are much less likely to show these grooves which, in some cases, may be produced by shrinkage during drying. Secondly, up to two superior lateral spines are stated to be present on the

middle tibia of the male *D. connectens*. This character is not mentioned for *Deinacrida* but such spines were present on all the specimens examined, except on one of *D. sonitospina*. Lastly, Ander uses the presence of ten to fourteen superior spines on the hind femora of specimens of *D. connectens* as a generic character. Two species of *Deinacrida*, *D. sonitospina* and *D. carinata* Salmon, also have these spines, so that the character is best regarded as being of specific significance only.

A detailed comparison of specimens of *Deinacridopsis connectens* Ander, *Deinacrida heteracantha* White (the type species of the genus), *D. rugosa* Buller, *D. carinata* and *D. sonitospina* reveals that *Deinacridopsis connectens* possesses no character that warrants its placing in a separate monotypic genus. *Deinacridopsis* Ander, 1939, is therefore a synonym of *Deinacrida* White, 1842.

Deinacrida connectens (Ander, 1939)

Deinacridopsis connectens Ander, 1939 : 293.
Deinacrida sonitospina Salmon, 1950 : 130–4, **syn. nov.**
Deinacridopsis connectens Ander, Salmon, 1955 : 21.
Deinacrida sonitospina Salmon, Salmon, 1955 : 22.

A comparison of the male and female type specimens of *Deinacrida connectens* and a series of specimens of *Deinacrida sonitospina*, including the types, from a number of different South Island localities, leaves no doubt that *D. sonitospina* is a synonym

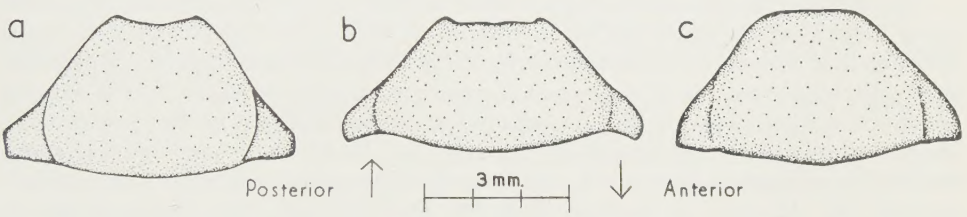

FIG. 1.—*Deinacrida connectens* Ander, female sub-genital plate: (*a*) typical "*sonitospina*" form, Lewis Pass (from a dried specimen); (*b*) a weakly emarginate specimen, Lewis Pass (from a specimen preserved in alcohol); (*c*) sub-genital plate of the allotype female in the Zoologisches Museum of the Humboldt University, Berlin (preserved in alcohol).

of *D. connectens*. A number of differences in coloration, leg spination and shape of the female sub-genital plate occur between the "*sonitospina*" and "*connectens*" specimens but the range of variation of "*sonitospina*" specimens is such that the "*connectens*" differences lie within it. A stridulatory organ consisting of a patch of numerous fine spines or pegs on each side of one of the abdominal tergites is present in both.

The coloration of the *D. connectens* specimens has altered very little since Ander originally described it as brownish-grey above with the vertex and hind edges of the nota dark brown. In *D. sonitospina* the hollows of the pronotum are usually etched in black, the remainder of the surface being pale grey or brownish-grey except for a thin dark band across the anterior border and a broader band across the posterior border. The margins of the pronotum of living specimens of this weta are usually tinged rosy-red, but this fades soon after death. This type of colour pattern is present on specimens from the Mt. Arthur Tableland (the type locality) and the Lewis Pass in Nelson, and from Mt. Torlese in Canterbury. A second type of colour pattern occurs on an adult male *D. sonitospina* from 5000 feet on Mt. de la Beche in the Tasman Valley (collected 4.i.56 (*J. S. Edwards*)). Here there is no black etching of the grooves and hollows of the pronotum and the lateral areas are orange-brown in colour. This specimen is relatively brightly coloured. An adult female *D. sonitospina* from the Takitimu Range in Southland possesses a third type of colour pattern. Here the

upper surface of the body is jet black except for two lateral brownish-grey areas, one on each side of the pronotum, separated by a black longitudinal band which narrows toward the centre of the plate, giving an hour-glass effect ; the hollows of the pronotum are etched in black.

The specimens of *D. connectens* are distinctly more brownish in colour than any of the *D. sonitospina* studied, but this could be due to their preservation. The pronotum has the anterior and posterior dark coloured transverse bands, but its hollows are not etched in black and the lateral areas are faintly tinged with orange. The colour pattern, especially in the male, resembles that of the *D. sonitospina* specimen from Mt. de la Beche.

The spination of the legs of *D. connectens* also differs from that of typical *D. sonitospina*. The fore femora of *D. connectens* possess a tiny prolateral spine while those of *D. sonitospina* have been described as unarmed. The spine is lacking in the paratype males of *D. sonitospina* but occurs in specimens from the Mt. Arthur Tableland, Lewis Pass, Mt. Torlese, Mt. de la Beche and the Takitimu Range. Again, the middle tibia of *D. sonitospina* usually lacks superior spines but two are present on the leg of the male *D. connectens*. However, such spines have been found on the middle tibiae of the holotype female *D. sonitospina*, a male from the Mt. Arthur Tableland and the male from Mt. de la Beche. In this character also the male *D. connectens* resembles the Mt. de la Beche male. Other minor differences in the spination occur but all are within the " *sonitospina* " range of variation.

The shape of the female sub-genital plate is different in *D. connectens* and *D. sonitospina*, a distinction which would be important if it were not for the fact that the shape of the plate is variable in *D. sonitospina*, in one specimen of which it closely approaches that of *D. connectens*. In *D. connectens* the plate is smooth and entire with a straight transverse posterior margin (fig. 1*c*), whereas in *D. sonitospina* it is often emarginate, the posterior border being broadly notched (fig. 1*a*). However, in one preserved specimen of *D. sonitospina* from the Lewis Pass the rear margin is straight but slightly recessed (fig. 1*b*), and in another, from Mt. Peel (Nelson), this margin is almost straight. The shape of the female subgenital plate is affected by shrinkage during the preparation of dried specimens, which causes the lateral parts of the plate to curve in against the base of the ovipositor, and also varies when viewed from different angles. Both these factors must be constant before detailed comparisons can be made. It seems that the shape of the female subgenital plate of the type specimens of *D. connectens* is at one extreme of a range of variation extending through various intermediate forms to the fully emarginate, broadly notched, typical *D. sonitospina* type. The male sub-genital plate is identical in *D. connectens* and *D. sonitospina*.

The fact that *D. sonitospina* is an alpine species found only in the South Island, whereas *D. connectens* is stated to have come from Auckland, in the North Island, is a further obstacle to the complete synonymy of the two. The collector of the *D. connectens* specimens was Dr. B. Friedländer of Auckland. It does not seem unreasonable to suggest that no locality data was given with the specimens when they were forwarded to Berlin and that the incorrect locality, Dr. Friedländer's home town (Auckland), was added later. The specimens may have been collected from a reasonably accessible area in the Tasman Valley region, such as the area around the Mt. Cook Hermitage. This would then explain the similarity between the *D. connectens* specimens and the male from Mt. de la Beche in the Tasman Valley.

At least three geographically separated colour varieties of *D. sonitospina* occur in the South Island : the typical form in the northern area, the de la Beche form in the central region and the dark form in Southland. *D. connectens* appears to be identical with the de la Beche form and *Deinacrida sonitospina* Salmon, 1950, therefore, is a synonym of *Deinacrida connectens* (Ander, 1939).

The type specimens are in the Zoologisches Museum, Humboldt University, Berlin.

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I wish to thank Dr. D. R. Ragge of the British Museum (Natural History), London, for making Walker's specimen of *Hemiandrus lanceolatus* available for study, Dr. H. Schiemenz of the Zoologisches Museum, Humboldt University, Berlin, for the generous loan of the type specimens of *Deinacrida connectens*, Dr. R. A. Falla for allowing me to examine the type specimens of *Deinacrida sonitospina* housed in the Dominion Museum, Wellington, and Dr. J. T. Salmon of the Victoria University of Wellington and Dr. W. Cottier of the Entomology Division, D.S.I.R., Nelson for helpful criticism after kindly reading the manuscript.

References

Alfken, J. D., 1903, Beitrag zur Insectenfauna der Hawaiischen und Neuseelandischen Inseln (Ergebnisse einer Reise nach dem Pacific. Schauinsland 1896–97). *Zool. Jahrb. Syst.* **19** : 561–628.

Ander, K., 1938, Diagnosen neuer laubheuschrecken. *Opusc. Ent.* **3** : 50–56.

—— 1939. Vergleichend-anatomische und Phylogenetische Studien über die Ensifera (Saltatoria). *Opusc. Ent.* (*Suppl.*) **2** : i–viii, 1–306.

Hutton, F. W., 1881, *Catalogues of the New Zealand Diptera, Orthoptera, Hymenoptera; with descriptons of the species.* Colonial Museum and Geological Survey of New Zealand. Wellington.

—— 1897, The New Zealand Stenopelmatidae. *Trans. N.Z. Inst.* **29** : 208–44.

—— 1899, Supplement to the Stenopelmatidae of New Zealand. *Ibid.* **31** : 40–43.

Karny, H. H., 1937, Orthoptera : Fam. Gryllacrididae, *in* Wytsman, P., *Genera Insectorum* **206** : 1–317.

Kirby, W. F., 1906, *A Synonymic Catalogue of Orthoptera.* II. *Orthoptera Saltatoria :* I. (*Achetidae et Phasgonuridae*). British Museum (Nat. Hist.), London.

Richards, A. M., 1958, Revision of the Rhaphidophoridae (Orthoptera) of New Zealand. II. The Genus *Macropathus* Walker in the British Museum (Nat. Hist.) Collection. *Trans. Roy. Soc. N.Z.* **85** : 465–70.

Salmon, J. T., 1950, A Revision of the New Zealand Wetas. Anostostominae (Orthoptera : Stenopelmatidae). *Dom. Mus. Rec. Ent.* **1** : 121–77.

—— 1955, A Key to the Tree and Ground Wetas of New Zealand. *Tuatara* **6** : 19–23.

Walker, F., 1869, *Catalogue of the Specimens of Dermaptera Saltatoria and Supplement to the Blattariae in the Collection of the British Museum.* I. British Museum (Nat. Hist.), London.

—— 1871, *Catalogue of the Specimens of Dermaptera Saltatoria in the Collection of the British Museum.* V. *Supplement to the Catalogue of Blattariae. Supplement to the Catalogue of Dermaptera Saltatoria.* British Museum (Nat. Hist.), London.

White, A., 1842, Description of an Orthopterous insect, and two new species of Crustacea, from New Zealand, in the collection of the British Museum, *in* Gray, J. E., *The Zoological Miscellany* **5**. London.

A NEW GENUS OF PENTATOMIDAE (HEMIPTERA : HETEROPTERA) FROM NEW GUINEA

By M. S. K. Ghauri

(Commonwealth Institute of Entomology, London)

Parafolengus gen. nov.

Body elongate elliptical, convex dorsally and strongly so ventrally, thickly and minutely punctate.

Head.—Longer than width between eyes, shorter than width including eyes, which are prominent but only slightly subpedunculate ; tylus slightly raised near base, broader apically than at base, distinctly shorter than juga whose apices are obtusely angulate ; a prominent tuberculous process on each side in front of eyes ; lateral margins of head beyond processes oblique for a short distance, then subparallel, slightly ampliate and recurved upward ; disc of head somewhat excavated immediately behind anteocular processes, the shallow furrow extending about half the posterior length of eyes. Ocelli moderately large, widely spaced and placed just behind a line drawn across posterior margins of eyes. Antennae about half as long as body, normally 4-segmented, basal and apical segments cylindrical, intermediate ones dilated, longitudinally, medially subcarinate ; first segment globular reaching apex of head ; second much longer than third and fourth, which are subequal and each longer than first (16 : 41 : 28 : 26) ; fourth fusiform, slender, base black, the rest orange. Bucculae well developed, raised, margin smooth, parallel, rounded anteriorly, ending obliquely posteriorly in line with middle of eyes. Rostrum very long extending well beyond anterior margin of fourth abdominal sternite ; first segment extending beyond hind margin of head, longer than third ; second the longest and laterally very much compressed ; third and fourth subequal (32 : 41 : 26 : 27).

Thorax.—Pronotum much wider than long with an irregular transverse sulcus just before the middle ending in shallow triangular pits along the lateral margins ; anterior margin less than half width of posterior margin, sinuate, medially raised in form of a narrow arcuate collar ; anterior angles subprominent ; posterior margin broadly rounded, posterior lateral angles rounded with a small prominence near margin. The ampliated and recurved lateral margins distinctly sinuate just before the middle. Calli rather prominent. Scutellum almost as long as wide at base, hardly reaching fifth abdominal segment ; lateral margins distinctly sinuate, frenum ending beyond two-fifths length, demarcated by a rough triangular depression on each side, apex rounded and slightly raised to the same extent as area of frenum. Sterna with a distinct but shallow median furrow extending on to fifth abdominal segment where it is barely a slight depression ; on prosternum it is triangular with base facing anteriorly, on meso- and metasternum somewhat flask-shaped with sinuous lateral margins, narrowed between the coxae. Legs moderately stout ; femora unarmed ; tarsi 2-segmented, basal segment much shorter than second (10 : 15) ; front and middle femora and tibiae subequal, former slightly longer than latter (50 : 49 and 59 : 57) ; hind femur slightly shorter than tibia (71 : 76). *Wing:*—Corium with a distinct levigate spot before apex ; membrane shorter than corium, reaching tip of abdomen, with 5 veins branching moderately, cross-veins few.

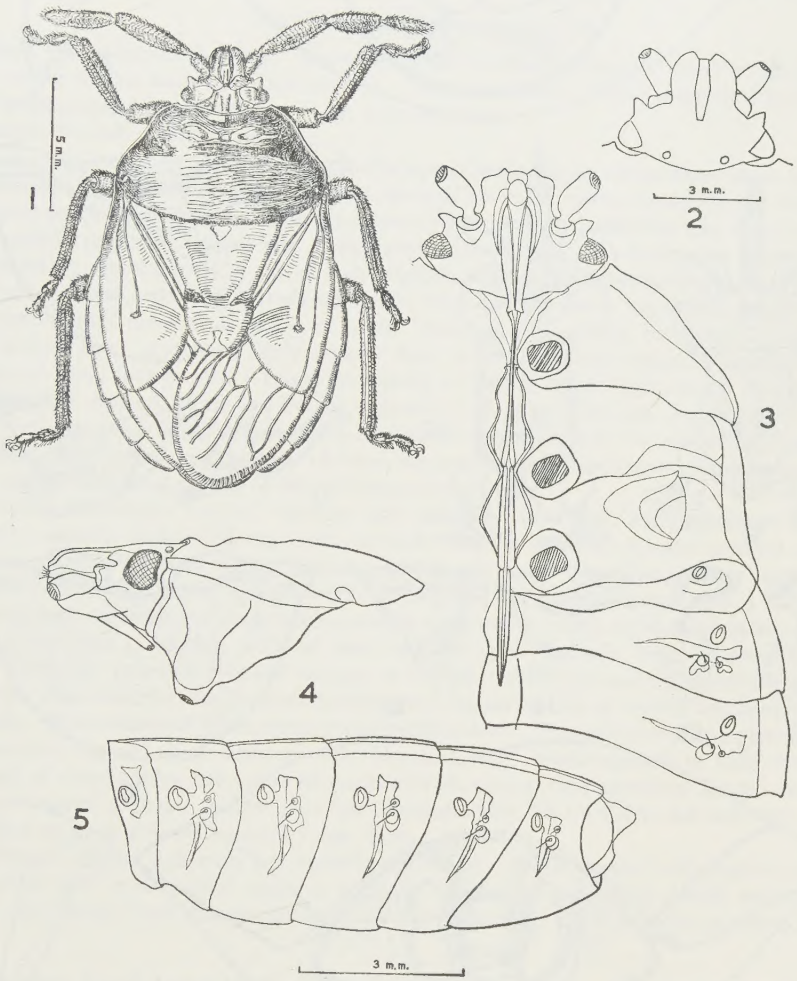
Abdomen.—Connexium widely visible from above, sub-laminate ; abdomen widest at fourth segment ; first spiracle completely exposed ; all spiracles situated near anterior margin of segments, a transverse elongate scar (duplicated on terga) separating them from well-developed trichobothria—the longer, inner one arising eccentrically from a larger basic circle, the shorter outer centrally from a smaller circle ; sternites centrally broadly impressed throughout, the furrow comparatively shallower on distal segments, becoming obscured on the last two. *Male genitalia* as figured.

Type species, *Parafolengus pipturuscus* sp. n.

Remarks.—This genus is intermediate between and very closely related to *Thalma* Walker (*T. bigutta* Walk.) and *Folengus* Distant (*F. papuensis* Dist., figs. 16–18).

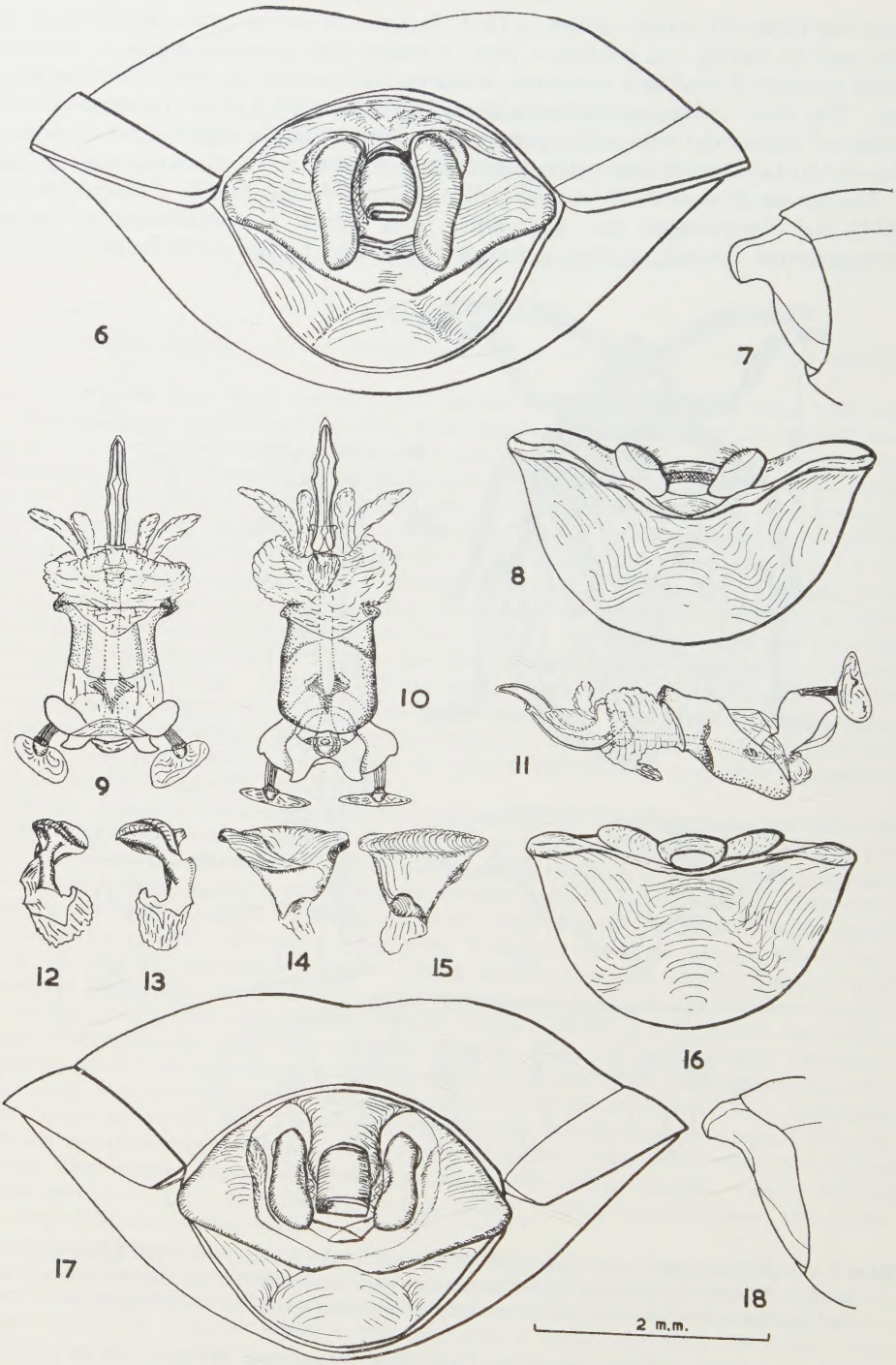
From the former it mainly differs in that the tylus is not so much shorter than the juga, and in having non-contigous juga, a longer first antennal segment, recurved lateral margins of head and pronotum, a shorter rostrum and comparatively less stout legs. The main differences between it and *Folengus* Dist. are the presence of well-developed anteocular tubercular processes, a shorter tylus, a slightly less prominent ridge on third and fourth antennal segments and comparatively longer antennae and legs.

The genera *Eumenotes* Westwood (1845), *Thalma* Walker (1868), *Folengus* Distant (1914) and *Parafolengus* gen. nov. differ from normal Tessaratominae in having two-segmented instead of three-segmented tarsi and in the much longer rostrum,



FIGS. 1–5.—*Parafolengus pipturuscus* gen. et sp. nov.: (1) dorsal view; (2) dorsal outline of head; (3) ventral outline of head, thorax and part of abdomen; (4) lateral outline of head and prothorax; (5) lateral outline of abdomen showing spiracles, trichobothria, *etc.*

and whereas typical Tessaratominae (including *Eumenotes* Westw., whose genitalia are under study) have all the three conjunctival appendages paired (Pruthi, 1925; Leston, 1954*a*), *Parafolengus* has only the second and third so, the first being single and median in position. Thus *Thalma*, *Folengus* and *Parafolengus* might well be regarded as forming a distinct tribe, the Thalmini. *Thalma* and *Folengus* are placed incorrectly by Kirkaldy (1909) and Distant (1914) in the Diniodorinae but are true Tessaratominae, with the exposed first abdominal spiracle.



FIGS. 6–18.—(6–15) *Parafolengus pipturuscus* gen. et sp. nov.: (6) external genitalia and pregenital segment, dorso-posterior view; (7) the same, lateral view; (8) the same, posterior view; (9) aedeagus, dorsal view; (10) the same, ventral view; (11) the same, lateral view; (12) paramere, anterior view; (13) the same, posterior view; (14) the same, internal view; (15) the same, external view. (16–18) *Folengus papuensis* Dist.: (16) genital segment, posterior view; (17) external genitalia and pregenital segment, dorsoposterior view; (18) the same, lateral view.

The Megyminini are also placed by Kirkaldy (1909) in the Diniodorinae although they possess the exposed first abdominal spiracle. However, a study of the genitalia of *Megymenum dentatum* Boisd. revealed the vesica to be entirely membranous, a typical character of Diniodorinae (Pruthi, 1925; Leston, 1954*b*). This rules out any relationship of *Parafolengus* with the Megyminini.

Remarks in the last paragraph seem to suggest that the character of the first abdominal spiracle does not always hold good, but to be absolutely positive about this requires extensive study of the genitalia and the position of the spiracle, which is beyond the scope of this paper.

Parafolengus pipturuscus sp. n.

Black, pleura brownish-black. Scutellum with an orange triangular mark in middle of base and a rather similar mark in middle of apex. Antennae black; fourth segment with base black, three-fourths apical length orange. Legs entirely black.

Length 17 mm., width 10 mm.

Head.—2·5 mm. long, 3 mm. wide including eyes, thickly rugose except base, which is somewhat smooth; tylus shorter than juga by about one-half its width, wider anteriorly but less than the maximum width of one jugum, distinctly raised at a point two-thirds of the way from its front end and narrowed gradually behind this, a thin brush of short, stiff, dark brown hair at its tip. Eyes reddish-brown, set obliquely to axis of body, slightly bulging beyond anterior angles of pronotum; anteocular processes pointing outwards parallel with base of eyes; transverse distance between their tips slightly more than length of head. Ocelli orange, widely separated by about twice distance from eye. Antennae finely setose; first, second and third segments covered with close stiff brown hair, fourth with a sparse scattering of longer orange hair among the short ones; length of first, second, third and fourth segments 1, 3, 2 and 1·8 mm. respectively. Rostrum black, 8·8 mm. long, first, second, third and fourth segments 2·2, 2·8, 1·9 and 1·9 mm. long; first extending beyond hind margin of head, second reaching mesocoxae, third metacoxae and fourth almost attaining middle of fifth abdominal sternite.

Thorax.—Pronotum convex, thickly and minutely punctate, with moderate transverse rugosity; anterior margin 3·5 mm. wide, medially raised in form of a narrow arch 0·4 mm. long; posterior margin 7·8 mm. wide; median length 4·2 mm. Scutellum thickly and minutely punctate, moderately rugose, orange marks at base and apex impunctate; with a minute triangular calloused depression at each tumid anterior angle and a rather similar depression separating frenum from apex; 4·9 mm. wide at base and 4·8 mm. medially long. *Hemelytra.*—Clavus rather uniformly punctate; costal margin of corium thickly punctate; remaining surface of hemelytra with shallow thinly scattered punctures; apical margin of corium moderately sinuate, recurved. Membrane dull black, veins prominently raised. Thoracic sterna and pleura unevenly punctate and rugose. Legs covered with close stiff hair; basal segment of tarsi with ventral thick pad of short golden hair; second segment with ventral thin growth of longish brown hair. Relative lengths of front, middle and hind femora-tibiae 3·5 : 3·4, 4·1 : 4·0 and 5·0 : 5·3 mm. Tarsi, first segment 0·8 mm., second 1 mm. long.

Abdomen.—Pleura uniformly but sparsely punctured; sterna covered with shallow punctures. In posterior view male genital segment ventrally cup-shaped, dorsal lip deeply concave with a median wide notch, hind margin distinctly sinuate laterally. *Male genitalia* as shown in figures 6–15.

Holotype ♂ and 3 paratypes, New Guinea, Manus Island, Lorengau, ex *Pipturus*, 1.x.1958 (*J. H. Ardley*). 1 ♂ paratype, New Guinea, Manus, 1932 (*N. E. H. Caldwell*), B.M. 1948–548. All specimens deposited in the British Museum (Natural History), London.

The species was found causing bark damage to *Pipturus*.

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I wish to express my gratitude to Dr. W. E. China, Keeper of the Department of Entomology, British Museum (Natural History) for his encouragement and valuable suggestions, which have been incorporated. I am also grateful to Mr. J. H. Ardley,

Entomologist, Department of Agriculture, New Guinea, for supplying additional material for description.

References

Distant, W. L., 1914, Report on the Rhynchota collected by the Wollaston Expedition in Dutch New Guinea. XI. *Trans. zool. Soc. Lond.* (1) **20** : 339.

Kirkaldy, G. W., 1909, *Catalogue of the Hemiptera (Heteroptera). I. Cimicidae.* Berlin.

Leston, D., 1954*a*, Wing venation and male genitalia of *Tessaratoma* Berthold, with remarks on *Tessaratominae* Stål (Hemiptera : Pentatomidae). *Proc. R. ent. Soc. Lond.* (A) **29** : 9–16.

—— 1954*b*, Notes on the Ethiopian Pentatomidae (Hemiptera) : XVII, Tessaratominae, Diniodorinae and Phyllocephalinae of Angola. *Publ. cult. Cia. Diam. Angola* **24** : 11–22.

Pruthi, H. S., 1925, The morphology of the male genitalia in Rhynchota. *Trans. ent. Soc. Lond.* **1925** : 127–254.

Walker, F., 1868, *Catalogue of the specimens of Hemiptera Heteroptera in the collection of the British Museum.* **3** : 503. London, Brit. Mus. (Nat. Hist.).

Westwood, J. O., 1845, Description of two new exotic Hemiptera in the cabinet of the British Museum. *Proc. ent. Soc. Lond.* **1845** : cxv.

Book Notice

Guide to the insects of Connecticut. Part VI. The Diptera or true flies of Connecticut. Fasc. 7. Psychodidae by L. W. Quate. 8vo. Middleton, Conn., 1960. Pp. v + 54, illust. [*Bull. Conn. geol. nat. Hist. Surv.* 92.]

This work is the most recent addition to the part of the *Guide to the insects of Connecticut* on the Diptera. It deals with the Psychodidae, which are among the most distinctive and varied families of this order and are considered by many specialists the most primitive of living Diptera.

Keys are given to the subfamilies of the world, genera of North America, and species of the northeastern region (Virginia to Labrador, westward to the Great Plains). As the larvae and pupae of the Psychodidae are mostly unknown, the preparation of keys to those below the subfamily level was not possible. The general distribution is noted, there is a selected bibliography, an index to the Latin names of these insects and seven pages of text figures.

THE ENIGMA OF *STROBILOESTRUS* BRAUER (DIPTERA : OESTRIDAE)

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History

The oldest species described and now assigned to *Strobiloestrus* is *Oestrus clarkii* Clark (1841). It was based on a single male, caught by Shuckard at the beginning of the last century at the Cape of Good Hope " inter pecora majora Capensia ". Brauer (1863), in his monograph of the Oestridae, lists this species too and gives Shuckard as author, but without any date, whereas van Emden (1944) gives the date of Shuckard's description as 1815.

Mr. H. Oldroyd, of the British Museum (Nat. Hist.), was kind enough to track down the early references of *O. clarkii* and found that Shuckard actually never described this species, but only labelled and presented it to B. Clark. This specimen is now preserved in the British Museum (Nat. Hist.). The earliest reference to it is that by Clark (1841 : 100), when he read the conclusion of his " Appendix or Supplement to a Treatise on the *Oestri* and *Cuterebrae* of various animals ". After giving a summary of the paper, the report says that Clark describes three species, including " *Oe. Clarkii* of Shuckard ", and gives the following characters, which are sufficient to validate the species :

> " *Oe. Clarkii*, caerulescenti-fuscus, alis obscuris antice sinuatis basin versus atro-bipunctatis.
>
> " *Hab.* ad Caput Bonae Spei ".

A more detailed description appeared in 1845, also by Clark.

In 1892, Brauer reviewed the oestrids then known from Africa and described two different kinds of larvae from the skin of antelopes which Dr. Holub had brought from South Africa. One had been found in swellings of the skin of the Klipspringer (*Oreotragus oreotragus*) in the Transvaal and of the Steenbok (*Raphicerus campestris*) in the Cape, the other came from the skin of a Kudu (*Tragelaphus strepsiceros*) in the Cape. Brauer called those larvae from the Klipspringer and the Steenbok, characterised by lobe-like protrusions of three anterior segments, *Strobiloestrus antilopinus* nov. gen. nov. spec., and those from the Kudu, which are similar to *Hypoderma* larvae, *Dermatoestrus strepsicerontis* nov. gen. nov. spec. Another species of *Dermatoestrus*, *D. ericksoni*, was then described by Poppius (1907) from the Black Lechwe (*Kobus leche smithemani*) at Haut-Louapoula, Katanga, based on two evidently fully mature larvae. Scheben (1910), on the other hand, found the Klipspringer in Namaqualand, SW. Africa, to be heavily infested with oestrid larvae which he assigned to the genus *Strobiloestrus* ; he called them *S. oreotragi*. It is interesting to note that Scheben found only the Klipspringer infested, and no other antelope.

In 1927 Rodhain published a basic paper on the relationship of the two genera *Strobiloestrus* and *Dermatoestrus*. This author had received several batches of larvae from the Red Lechwe (*Kobus leche leche*) collected by Dr. Dupuy near Bukuma at the Katobwe River. He had also succeeded in catching two oestrid flies on a freshly killed lechwe. Studying this material, Rodhain found to his surprise that some of the larvae had to be assigned to the genus *Strobiloestrus* whereas the other, larger, species belonged to *Dermatoestrus*. The two adults represented a fly not yet described but Rodhain did not dare to refer them to the extracted *Dermatoestrus* larvae.

At Rodhain's request, Dr. Miguens, who had succeeded Dr. Dupuy, collected more larvae from the Lechwe and reared one male and two females from extracted *Dermatoestrus*, which proved to be identical with those caught previously on the dead Lechwe. Furthermore, Rodhain was able to prove definitely that the so-called *Strobiloestrus* and *Dermatoestrus* actually belonged to one and the same genus, the former representing the second larval stage, and the latter the third. The valid name is *Strobiloestrus*, which has page priority over *Dermatoestrus*. This fact has been overlooked by van Emden (1944) and by Hennig (1952), who use the name *Dermatoestrus*.

Rodhain saw one of Poppius' larvae and found it identical with those from the Red Lechwe in Katanga. In his paper he therefore assigns the third stage larvae and the adult flies of his material to this species, describes both under this name and also gives a figure of the wing. A few pages further on, however, he discusses the second larval stage and compares it with the larva of *Strobiloestrus antilopinus*, described by Brauer from the Klipspringer and the Steenbok. He found them identical and synonymised *Dermatoestrus ericksoni* with *Strobiloestrus antilopinus*.

Rodhain could not clarify the status of *Dermatoestrus strepsicerontis* and of *Strobiloestrus oreotragi*, which he found different from his material.

Present Investigations

I have studied material from the following hosts and localities:

Host	Locality		Larval stage	Adult
Kobus leche (Red Lechwe)	Lochinvar, nr. Monze, N. Rhodesia,	27.vii.1959	II and III	.
		21.x.1959	II and III	2 ♂, 1 ♀ hatched 17–21.xi
		26.x.1959	III	.
		6.xi.1959	Empty swellings	.
		x.1956	II and III	.
	Katanga		III	.
Oreotragus oreotragus (Klipspringer)	Rustenburg distr., Transvaal		II (types).	
	Urungwe, Natal, v.1936		III	.
Raphicerus campestris (Steenbok)	Deelpan, Transvaal, 17.v.1947		III	.
	Pietersburg distr., Transvaal, 6.vi.1932		III	.
	Hoopstad, Orange Free State, 4.ii.1938		II	.
	Tamboerskloof, Cape Prov.		III	.
	Darling, Cape Prov., vi.1938		III	.
	Debeete, Bechuanaland, 20.i.1956		II	.
	Palapye, Bechuanaland, 7.v.1957		III	.
	Kalkfeld, S. W. Africa, 14.v.1924		III	.
	Kovares, Kaokoveld, S.W. Africa		II	.
	Kaokoveld, S.W. Africa, 4.iv.1927		II	.
Tragelaphus strepsiceros (Kudu)	Cape		III (types)	.
Pelea capreolus (Vaal Rhebok)	Giant's Castle, Natal, vi.1927		III	.
Redunca fulvorufula (Mountain Reedbuck)	Pretoria distr., Transvaal, 10.vi.1939		III	.
	Vryheid, Natal, viii.1938		II	.
Redunca arundinum (Common Reedbuck)	Nongoma, Natal		II	.
	Umfolosi, Natal, 1943		III	.
Goat	Pretoria distr., Transvaal, i.1957		II	.

Bedford (1927) records "*Strobiloestrus antilopinus*" from a horse in the Somerset West district, Cape Province, 1922. This, or these, specimens are not in the collection

of the Veterinary Research Laboratories, Onderstepoort. I very much doubt whether this record is reliable.

Strobiloestrus *from the Red Lechwe on Lochinvar*

Many specimens have been obtained from the Red Lechwe on Lochinvar. I stayed in this game sanctuary from 17th July until 5th August and again from 20th October until 10th November, 1959. A fair number of Lechwes were examined and more than half of them were found to be infested. The percentage was probably higher and may even have been 100 per cent., because only swellings containing older larvae of the second and third stages could be detected in the field. The number of swellings of each Lechwe varies greatly and is certainly also dependent upon the season and the year. According to the game ranger, Mr. J. G. van Zyl, and other local people, the antelopes are more heavily infested some years than others. I was also told that the greatest number of fully grown larvae is found during the months of October–November and April–May, that is, at the beginning and end of the dry season.

My findings seem to confirm this statement. The Lechwe examined on 27th July contained larvae of the second and third stages. The smallest second stage larvae dissected measured about 9 mm. in length and showed long and slender lobes, similar to those figured by Brauer for his *S. antilopinus*. The largest specimens of the second stage measured about 16 mm. in length and were characterised by much stouter and shorter protuberances, as figured by Scheben for his *S. oreotragi*. Between these two extremes all kinds of transitional forms were found. This shows that the second larval stage undergoes a pronounced body-modification while ageing. The specimens of the third larval stage varied from 18 to 24 mm. in length (measurements from larvae in alcohol) and also showed a modification, in that the body scales of the larger larvae were brown to almost black, whereas those of the smaller specimens were pale. The maturing larva therefore grows in length, becomes more heavily chitinised and consequently more darkly coloured, but none of these larvae had evidently reached full maturity and no adults hatched. Second larval stages were still present in another Lechwe examined on 26th October, but relatively more third larval stages were detected and many of them were fully mature, showing blackish body scales and having a length up to 27 mm. Those isolated on dry sand yielded three adults after my return to Johannesburg. These flies hatched at night on the 17/18 (♂), 18/19 (♀) and 20/21 (♂) November. On 26th October a third Lechwe was killed and was found to be infected too, but only a few maggots of the third larval stage were detected. Unfortunately none of these hatched. On 6th November the last Lechwe was examined, but only empty swellings were found, with a small amount of pus in them. Adults on the wing were never detected, either on the first or second trip to Lochinvar. The search for eggs and the first larval stage was also unsuccessful. In order to detect the latter, large portions of skin and also several parts of the spinal canal and the surrounding tissue were dissected and dissolved in potassium hydroxide.

To my great surprise, a study of the hatched adults revealed that they were not identical with the species described by Rodhain from the Red and the Black Lechwe in the Belgian Congo. They represent a closely related but undoubtedly new species, which is described below as *Strobiloestrus vanzyli*.

I have preserved a great number of larvae of both stages not only from those specimens of Lechwe listed above, but also many of the third larval stage which had been collected by Mr. van Zyl from other Lechwes. As already mentioned, the shape of the second larval stage varies greatly with age, but otherwise there are apparently no features which can be used to separate them from the *Strobiloestrus* larvae figured and described by Brauer and by Scheben. The larva described by Brauer represents a young second instar, that by Scheben an old one. The specimens of the third

larval stage show a great variability in the arrangement and number of the scales as well as in their shape. I am not able, at least at present, to separate these larvae clearly from the larva of *S. strepsicerontis* figured by Brauer, or from those which I have seen from other antelopes (*see below*). I have also not succeeded in finding differences between the larvae from the Lechwes on Lochinvar and in Katanga, in spite of the fact that they represent two different species.

The genus *Strobiloestrus* is to be placed in the Hypoderminae ; the most closely related genus is probably *Pavlovskiata* Grunin (1956), from a Palaearctic antelope. The life-histories of the two Holarctic *Hypoderma* species are fairly well known. The eggs are attached to the hairs ; the first larval stages burrow into the skin and make their way through the intermuscular connective tissue, finally lodging in the back of the animal. The swellings due to *Strobiloestrus* are quite similar to those caused by *Hypoderma*. The young second instar larvae remain in a closed swelling, the older ones cut a hole through the skin to the surface and then moult to the third instar. It is therefore to be expected that the early life history also resembles that of *Hypoderma*, though this has still to be proved.

In this connection, it should be mentioned that the *Hypoderma* larvae in cattle, on their way to the back, sometimes invade the spinal canal and penetrate the cord. A more or less severe paralysis of the hind legs may follow. Paralysis of the hind legs, or even a more complete one, is often observed in Lechwes on Lochinvar. I have examined some of these sick specimens and all of them showed pathological changes of the bones and the tissue, which were evidently due to mechanical injuries. These had been caused most probably by snares or by poaching natives, who spear them while swimming in the water, or who use dogs to chase them. Although the lameness of a great number of Lechwes can certainly be explained by these facts, it is quite probable that they are not the only cause, but that in some cases, the penetration of the spinal cord by the *Strobiloestrus* larvae is responsible for the paralysis.

If it is true that there are two peaks of accumulation of mature larvae in the year, there should be two generations of flies.

The *Strobiloestrus* of the Red Lechwe on Lochinvar seems to be strictly host-specific. I have checked a few specimens of Oribi (*Ourebia ourebi*), Bushbuck (*Tragelaphus scriptus*), Impala (*Aepyceros melampus*) and Blue Wildebeest (*Connochaetes taurinus*), which live fairly close to the Lechwe. No traces of infection with *Strobiloestrus* were found ; furthermore, Mr. van Zyl has stated that other species of antelope have never been found infected with warble flies.

Strobiloestrus *from the Red and the Black Lechwe in the Belgian Congo*

The adult flies received by Rodhain (1927) from larvae from the Red Lechwe at the Katobwe River are, according to the description, clearly separable from *Strobiloestrus vanzyli* by their smaller size, the closed R_5 and other features. Rodhain was probably right in assigning this species to *S. ericksoni* (Poppius). However, I cannot follow him in synonymising the second larval stage with *S. antilopinus* Brauer from South Africa, which I believe may represent the second instar of *S. clarkii* (Clark).

Strobiloestrus *from South African Antelopes*

It is very unfortunate that no reared adults are available from *Strobiloestrus* larvae in South African antelopes, but there is hardly any doubt that the only specimen of *S. clarkii* has come from one of the antelopes found infected with *Strobiloestrus* in the Cape Province, namely the Klipspringer, the Steenbok or the Kudu.

I could examine only one specimen of the Klipspringer at Kanye, Bechuanaland and it was not infested. The Klipspringer has become a rare antelope in South Africa and is therefore strictly protected. Scheben (1910), however, shot quite a

number in Namaqualand, SW. Africa, and he found them heavily infested. It is therefore possible that the Klipspringer represents the main host of *S. clarkii* and that *S. antilopinus* is the second larval stage of this species.

Several times, and in various parts of South Africa, the Common Steenbok has been found infected with both larval stages of *Strobiloestrus*. They are not separable from those found in the Klipspringer and, what is more important, both kinds of antelopes often occur in the same habitat. There is hardly any doubt that we are dealing with the same species of *Strobiloestrus*. I have shot a fair number of steenbok, but found only one specimen infected with larvae of warble flies. Furthermore, the records available reveal that the level of infection is probably never as high as in Klipspringer and Lechwe. I therefore presume that the Steenbok acts only as a secondary host for *Strobiloestrus clarkii*.

Whether the Kudu plays an important role as host of *S. clarkii* remains doubtful, but as this antelope also often occurs with Klipspringer, the infestation with *Strobiloestrus* is easily explained, and *S. strepsicerontis* should fall into the synonymy of *S. clarkii*.

The Vaal Rhebok and the Mountain Reedbuck are rare antelopes, and it will hardly be possible in future to investigate on a broad scale their role as hosts of *S. clarkii*, or to state whether we are perhaps dealing with a distinct *Strobiloestrus* species. Both live, however, in habitats where they may meet Klipspringer.

The Common Reedbuck normally lives in a habitat which is quite different from that of the Klipspringer, and I presume that the *Strobiloestrus* from this host is not identical with *S. clarkii*. The Common Reedbuck may meet the Lechwe in his habitat, but there are no Lechwe in Natal, whence the two records have come. It is possible that the *Strobiloestrus* from the Reedbuck in Natal represents a further distinct species.

The record from the goat is very interesting and shows that warble flies of the genus *Strobiloestrus* have a potential veterinary importance. Goat, Klipspringer and Steenbok easily come into contact with one another in the bush, and it is supposed that this infection was due to *S. clarkii*.

Description of **Strobiloestrus vanzyli** sp. n.

I have been able to investigate the only known adult, a male, of *S. clarki* (Clark), now preserved in the British Museum. It is quite similar to the new species, but bigger (14–15 mm. in length), the legs darker with only the knees and tarsi yellow-brown, and the abdomen stouter (about as long as broad) and more roughly sculptured. The hypopygium could, of course, not be dissected. The specimens on which Rodhain based his description of what is called *S. ericksoni* (Poppius) in this paper, are apparently lost. According to the diagnosis, they were only 10–11 mm. long and the wings showed a closed R_5.

Male (Plate I, fig. 1).—Eyes bare, with small facets. Frons at its narrowest point (near level of anterior ocellus) measuring four-sevenths of eye-length in the holotype, a little more in the paratype ; frons slightly widened towards occiput, more strongly towards antennae ; ocellar triangle well-defined, black and reddish brown, with three big ocelli ; frontal stripe reddish brown, slightly narrowed at tip of ocellar triangle. Parafrontalia dark yellow to yellow-brown, with a large black spot bordering upper eye-margin and covering half the width of each parafrontalium, upper margin of this spot level with tip of ocellar triangle ; parafrontalia in their whole extent provided with relatively small and shallow, partly confluent, pits which bear pale setae. Face yellow, parafacialia very narrow, bare and smooth, interfacialium completely bare, covering whole width of face, separated from facial ridges only by a shallow and narrow groove. Antennae lie in deep round pits broadly separated from one another ; basal segments yellow, third segment deep black, globate, with a long, bare, yellow, arista ; second segment cup-shaped, but short, covering basal part of third segment. Mouth parts strongly reduced, only a glossy, black, knob-like fragment of proboscis visible ; palpi completely wanting ; buccae narrow, with pale and short hairs ; occiput yellow and yellow-brown, with pale hairs.

Thorax reddish-brown, with broad and glossy black weals, parts yellow and silvery-white pollinose with short yellow hairs. Pair of median longitudinal weals in front of the suture, pair of round ones behind. On lateral parts of mesonotum, ill-defined, broad weals extend from humeral callus on to base of scutellum, and another broad one is situated on super-alar area. Scutellum yellow-brown, shrivelled, bristles not developed. Thorax on each side, behind the humeral callus and in front of the suture, with one big hump-like protrusion provided with several short setae. Pleura glossy, yellow-brown and partly blackish. Sparse pale hairs replace all bristles including those on the hypopleuron. Postscutellum glossy black, strongly bulging, with 3 longitudinal fovae. Wings with a dark tinge, especially towards the outer margin, veins yellow-brown except at base of wing where partly black ; large glossy black spot on alula and 2 small

Fig. 1.—*Strobiloestrus vanzyli* sp.n. : cerci with paralobi and phallosome (drawing from slide).

dots on basal part of r_1 and near alula in front of large spot. Compared with the drawing of the wing of *S. ericksoni*, given by Rodhain, R_5 is broadly open and *tp* (posterior crossvein) relatively longer. Thoracic squama very broad, white ; haltere yellow. Legs yellow, femora partly dark-brown.

Abdomen a little longer than broad. Tergites blackish with hind margins broadly yellow-brown. Surface quite uneven, covered with shallow, ill-defined and confluent cavities which are yellow and partly silvery pollinose, so that a tessellated pattern arises. Hairs sparse, yellow and adpressed. Border of tergite IV markedly incised ; tergite I + II with a shallow line in middle indicating original separation. Venter dark brown to blackish, sternites broad, but separated from tergites by broad intersegmental membranes. Hypopygium black ; cerci and paralobi broad and short ; phallosome slender (fig. 1).

Female.—Frons much broader than in male and almost parallel, at tip of ocellar triangle nearly as broad as eye is long. Frontal stripe also parallel and parafrontalia relatively broader than in male. Ovipositor strongly chitinized.

Length : 13–14 mm.

Two males emerged during the night of 17/18 and 20/21 (holotype) November

and one female on 18/19 November ; all three reared from extracted larvae isolated on sand on 21st October, 1959.

Holotype ♂, allotype ♀ and 1 ♂ paratype in collection of the South African Institute for Medical Research, Johannesburg.

The species is named in honour of Mr. J. G. van Zyl, manager and honorary Game Warden on Lochinvar.

As already mentioned above, many specimens of the second and the third larval stages were obtained.

Second instar with 12 visible segments. Colour ivory white. Length of the larvae varies from 9 to 16 mm. The smaller specimens characterised by lobulated protrusions which are especially long on the fifth and sixth segments, much shorter on the anterior ones ; on the posterior segments, these protrusions reduced to low pads. Three lateral pairs of these protrusions on each segment, except segment I + II and XII. In larger specimens, protrusions much shorter and stouter. All kinds of transitional forms were found in the material collected (Plate I, fig. 2). Cephaloskeleton minute ; posterior stigmal plates each containing about 15 pores ; very fine spinulation, only detectable at high magnification, visible on last segment (Plate I, fig. 3).

Third instar with same number of segments as second, but lobe-like protrusions replaced by pads which bear patches of scales. Most segments with 12 patches, 3 each on dorsal and ventral sides and 3 pairs laterally ; on the anterior and posterior segments they are more or less reduced ; quite indistinct on segment I + II and only 9 in number on segment III ; number of patches reduced on segments X and XI, and completely wanting on segment XII. Number and shape of scales forming patch, as well as general arrangement of patches, variable. Sometimes 2 patches may be united, or one or other may be wanting. A fine spinulation visible ventrally on posterior parts of segments (Plate II, fig. 4). Cephaloskeleton well developed with oral hooks protruding ; antennal humps deep black and strongly chitinized ; posterior spiracles closed (Plate II, fig. 5). The specimens before me measure from 18 to 27 mm. in length. Younger specimens yellow-white with pale scales ; mature larvae darker in colour with deep black scales.

Pupal case similar to that of *Hypoderma*. Length 19–20 mm. (Plate II, fig. 6).

Summary

1. Rodhain's statement (1927) that *Strobiloestrus* Brauer (1892) represents the second larval stage of *Dermatoestrus* Brauer (1892) has been confirmed. *Strobiloestrus* has page priority.

2. There are two species of *Strobiloestrus* parasitising the Lechwe (*Kobus leche*), namely *S. ericksoni* (Poppius) in the Belgian Congo and *S. vanzyli* in Northern Rhodesia. The adults of both species are known. *S. vanzyli* is described from three reared adults (2 ♂, 1 ♀).

3. *S. ericksoni* and *S. vanzyli* seem to be strictly host-specific. The second and the third larval stages are not yet separable from one another or from *Strobiloestrus* species in South African antelopes.

4. *Strobiloestrus clarkii* (Clark) was based on one male caught on the wing in the Cape. The larval stages of this species have probably been described by Brauer (1892) as *S. antilopinus* (young second instar) from the Klipspringer (*Oreotragus oreotragus*) and the Steenbok (*Raphicerus campestris*), by Scheben (1910) as *S. oreotragi* (old second instar) from the Klipspringer and by Brauer (1892) as *Dermatoestrus strepsicerontis* (third instar) from the Kudu (*Tragelaphus strepsiceros*) in Southern Africa.

5. The main host of *S. clarkii* seems to be the Klipspringer, and Steenbok and Kudu are presumably only secondary hosts. Other hosts of secondary importance are probably the Vaal Rhebok (*Pelea capreolus*), the Mountain Reed-buck (*Redunca fulvorufula*) and the Domestic Goat.

6. It is suggested that the infestation of the Common Reed-buck (*Redunca arundinum*) with *Strobiloestrus* larvae in Natal may be due to another distinct species.

7. No egg or first larval stage of any of these *Strobiloestrus* species has been found yet, but the life-history is expected to be similar to that of the genus *Hypoderma*.

8. Specimens of the Lechwe on Lochinvar in N. Rhodesia are often found to be more or less paralysed in the hind legs. Those cases examined were due to mechanical injuries, but it is possible that there is also a paralysis which is caused by the first larval stage of *Strobiloestrus* penetrating the spinal cord.

Acknowledgments

The investigations on Lochinvar in N. Rhodesia were financed by a bursary from the Royal Society and Nuffield Foundation, for which I wish to express my thanks. I am, furthermore, greatly indebted to the authorities of the Federation of Rhodesia and Nyasaland for their help and support, to the board of Nanga Estates Ltd. and to Mr. J. G. van Zyl, manager and honorary game warden of Lochinvar. The equipment for the field investigations was provided by the South African Institute for Medical Research and the photographic work was done by the Photographic Department of this Institute.

These studies form part of a survey of arthropod parasites of vertebrates in Africa south of the Sahara, which is being carried out under the auspices of the South African Council for Scientific and Industrial Research.

References

Bedford, G. A. H., 1927, Check-list of the Muscidae and Oestridae which cause myiasis in man and animals in South Africa. *11th & 12th rep. Dir. Vet. Educ. Res.* : 483–91.

Brauer, F., 1863, *Monographie der Oestriden.* W. Braumüller, Wien. 291 pp., 10 pls.

—— 1892, Ueber die aus Afrika bekannt gewordenen Oestriden und insbesondere über zwei neue von Dr. Holub aus Südafrika mitgebrachte Larven aus diesser Gruppe. *Sitz.-Ber. Akad. Wiss. Wien. math.-nath.* **101** : 4–16.

Clark, B., 1841, An appendix or supplement to a treatise on the Oestri and Cuterebrae of various animals. *Proc. Linn. Soc. Lond.* **1841** : 100.

—— 1845, An appendix or supplement to a treatise on the Oestri and Cuterebrae of various animals. *Trans. Linn. Soc. Lond.* **19** : 81–94.

Grunin, K. J., 1956, Ueber die in *Gazella subgutterosa* Gueld. schmarotzenden Dasselfliegen (Diptera, Hypodermatidae). *Rev. Ent. URSS* **35** : 716–23, 10 figs. [*in Russian, German summary*].

Hennig, W., 1952, *Die Larvenformen der Dipteren, III.* Akademie-Verlag, Berlin. 628 pp., 21 pl., 338 figs.

Poppius, B., 1907, Eine neue Art der Oestriden Gattung *Dermatoestrus* Brauer aus Central Africa. *Öfv. Finska Vetensk. Soc. Förh.* **49** : 1–3.

Rodhain, J., 1927, Contribution à la faune des Oestridés du Congo belge. *Ann. Parasit. hum. comp.* **5** : 193–213, 7 figs., 1 pl.

Scheben, L., 1910, *Strobiloestrus oreotragi* nov. spec. Eine neue Oestridenlarve vom Klippbock (*Oreotragus saltatrix*) und sonstige parasitierende Dipteren aus Deutsch-Südwestafrika. *Centrbl. Bakt.* **56** : 50–54, 7 figs.

van Emden, F., 1944, Keys to the Ethiopian Tachinidae. I. Phasiinae. *Proc. zool. Soc. Lond.* **111** : 389–436, 3 pls.

PLATE I

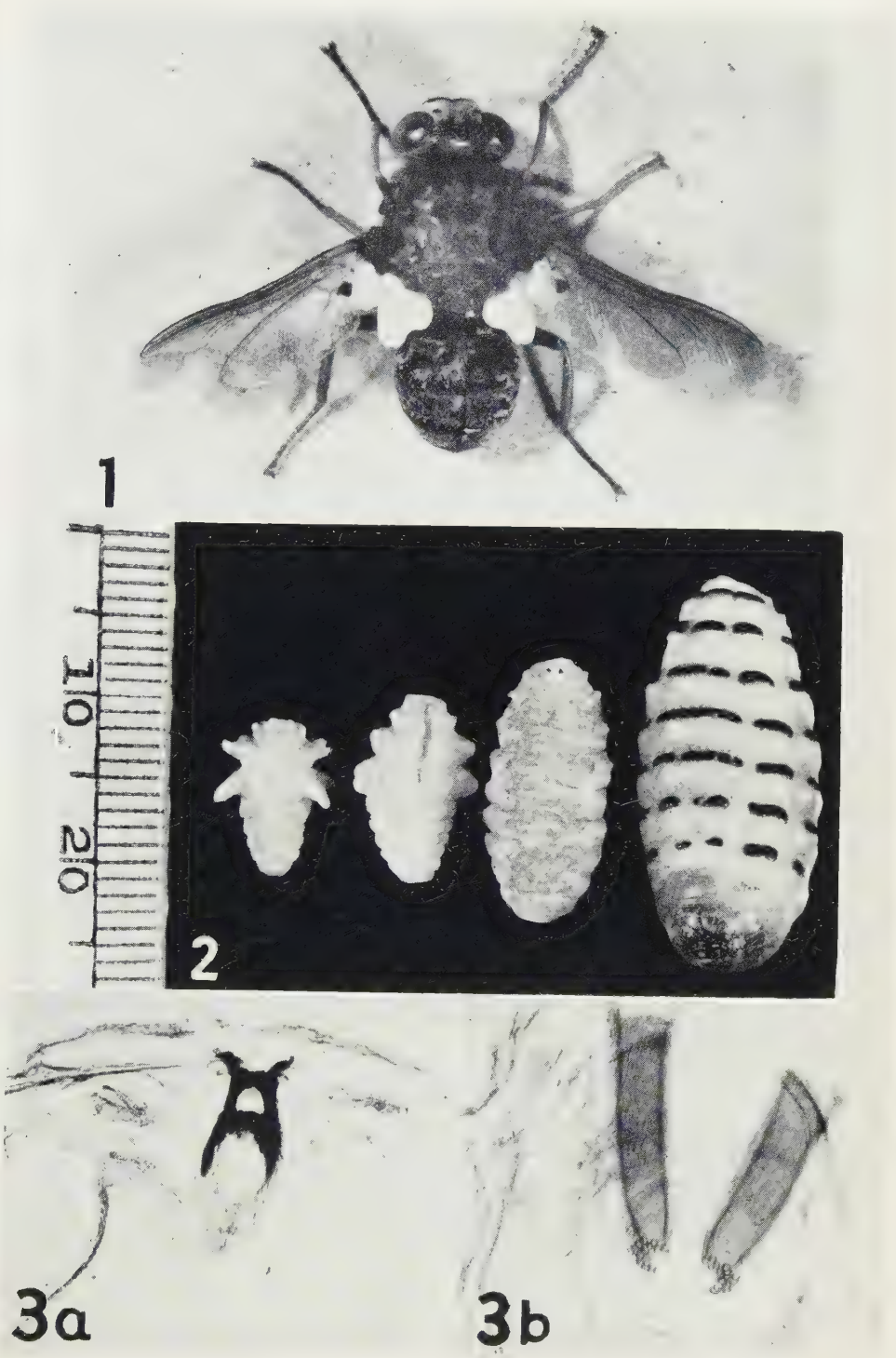
Strobiloestrus vanzyli sp. n.

Fig. 1.—Photograph of male fly.
Fig. 2.—Young and old larvae of the second and third instars.
Fig. 3.—(*a*) Cephaloskeleton and (*b*) posterior spiracles of the second larval stage.

PLATE II

Strobiloestrus vanzyli sp. n.

Fig. 4.—Three specimens of the third larval stage, showing the variability.
Fig. 5.—(*a*) Cephaloskeleton and (*b*) posterior spiracles of the third larval stage.
Fig. 6.—Empty pupal case.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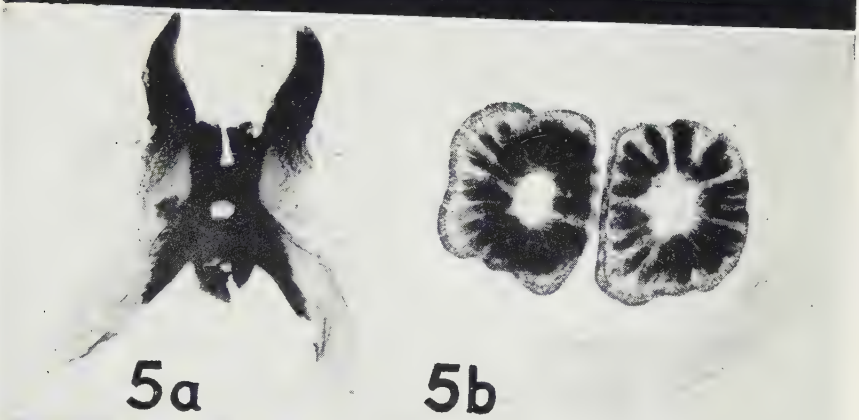
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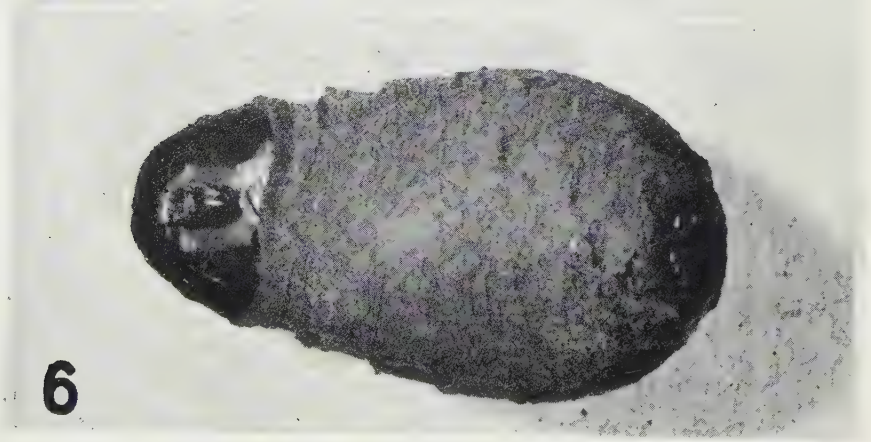
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THE UNKNOWN MALES OF THE THREE MUTILLIDS DESCRIBED FROM JAMAICA (HYMENOPTERA : MUTILLIDAE)[1]

By Clarence E. Mickel

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Mr. Thomas H. Farr, Entomologist, Science Museum, Institute of Jamaica, Kingston, Jamaica, recently sent me a collection of Jamaican Mutillidae for examination and study. Only three species of Mutillidae have been described or recorded from Jamaica and these were known only as females. The Farr collection included males of each of these. Descriptions of the males follow, together with comments on the relationship of *Dasymutilla militaris* (Smith) described from Jamaica and *D. nigriceps* (Cresson) described from Cuba.

Pseudomethoca cargilli (Cockerell)

Mutilla sp. Townsend, 1895, *Journ. Instit. Jamaica* **2** : 168.
Sphaerophthalma cargilli Cockerell, 1895, *Psyche, Camb.* **7** : suppl. 16, female.
Ephuta (*Ephuta*) *Cargilli* André, 1903, *Genera Insectorum* **11** : 58, female.
Dasymutilla cargilli Mickel, 1928, *Psyche, Camb.* **35** : 27, female.
Pseudomethoca cargillii Krombein, 1949, *Ent. News* **60** : 72, female.

Type ♀, West Indies : Gordon Town, Jamaica (*Dr. Cargill*), in U.S. National Museum.

The male, heretofore undescribed, is as follows :

Male. Entirely black, except the ivory white calcaria ; front, vertex and genae clothed with dense appressed and moderately thick, suberect, silvery pubescence ; posterior marginal fringe of second abdominal tergum, and terga three to five entirely, silvery pubescent ; mandibles edentate and with a single tooth within near the tip ; clypeus densely punctate, clothed with erect, silvery pubescence ; scape bicarinate beneath ; first segment of flagellum three-fourths the length of the second ; anterior half of pronotum, propleura and mesopleura entirely, clothed with sparse, silvery pubescence ; mesonotum with sparse, coarse, suberect, black hairs and scattered, erect, black hairs ; pronotum moderately punctate, except the posterior margin glabrous, impunctate ; mesonotum with close, moderate punctures ; parapsidal furrows present only on posterior half of mesonotum ; scutellum densely punctate, slightly depressed at the median line ; dorsum and posterior face of propodeum reticulate ; dorsal third of mesopleura with small, close punctures, the ventral two-thirds with moderately large, close punctures ; metapleura and sides of propodeum glabrous ; tegulae glabrous, the anterior and lateral margins with moderately large punctures and coarse, suberect, black hairs ; first abdominal segment subsessile, about three-fifths the length of the hind femur, the posterior dorsal margin closely punctate, clothed with scattered, erect, inconspicuous, pale hairs ; second abdominal tergum glabrous, with only a few, scattered, small punctures, except the posterior margin closely punctate ; terga three to seven closely punctate, the punctures on three to five smaller and closer than on terga six and seven ; second abdominal sternum with moderate, well separated punctures ; sterna three to seven closely punctate ; sterna one to five with sparse, erect, silvery hairs, sterna six and seven with black hairs, legs black, clothed with sparse, silvery pubescence and scattered, erect, silvery hairs ; calcaria white ; wings subhyaline, the distal fourth of both front and hind wings fuscous.

[1] Paper No. 4506 of the Scientific Journal Series of the Minnesota Agricultural Experiment Station.

Allotype ♂, West Indies: Portland, Hardwar Gap, trail to Caledonia Peak, Jamaica, 18.vii.1958 (*T. H. Farr*), in collection of Science Museum, Institute of Jamaica.

Alloparatypes, West Indies: Portland, Hardwar Gap, trail to Caledonia Peak, Jamaica, 18.vii.1958 (*T. H. Farr*), 19 ♂; Portland, Hardwar Gap, 24.vi.1958 (*T. H. Farr*), 1 ♂; Portland, Hardwar Gap, 3.viii.1958 (*T. H. Farr*), 1 ♂; Portland, Hardwar Gap to Caledonia Peak, 30.x.1955 (*T. H. Farr*), 1 ♂; Hermitage reservoir, St. Andrew, Jamaica, 28.v.1956 (*T. H. Farr*), 1 ♂.

Females examined: 1 ♀, West Indies: Portland, Hardwar Gap, Jamaica, vii.1958 (*P. Alayo*); 1 ♀ Clydesdale, St. Andrew, Jamaica, 3500 ft., 20.viii.1949 (*E. Baxter*).

The male superficially resembles the male of *Dasymutilla militaris* (Smith) (*see below*), but differs in the dense white pubescence of the head, the subsessile first abdominal segment, silvery pubescent markings of the abdominal terga and the absence of a median fuscous area in the front wing.

Dasymutilla militaris subsp. *militaris* (Smith)

Mutilla militaris Smith, 1855, *Cat. Hymen. Brit. Mus.* **3**: 61, female.
Mutilla militaris Cresson, 1863, *Proc. ent. Soc. Philad.* **1**: 322, female.
Mutilla militaris Blake, 1871, *Trans. Amer. ent. Soc.* **3**: 256, female
Mutilla militaris Blake, 1886, *Ibid.* **13**: 222, female.
Mutilla militaris Dalle Torre, 1897, *Cat. Hymen.* **8**: 62, female.
Mutilla militaris André, 1898, *Ann. Soc. ent. Fr.* **67**: 53, female.
Mutilla militaris André, 1903, *Genera Insectorum* **11**: 61, female.
Dasymutilla militaris Mickel, 1928, *Psyche, Camb.* **35**: 27, female.

Type ♀, West Indies: Jamaica, in British Museum (Natural History).

Allotype ♂, West Indies: St. Andrew, Long Mt., NE. slope, Jamaica, 26.iv.1956 (*T. H. Farr*), in Science Museum, Institute of Jamaica.

Females examined: 1 ♀, West Indies: Bay road, Yallahs River, at Morant, St. Thomas, Jamaica, 6.xi.1954 (*T. H. Farr*); 1 ♀, Long Mountain, St. Andrew, Jamaica, 23.viii.1958 (*T. H. Farr*); 1 ♀, Jamaica (*W. Schaus*).

The male has heretofore been unknown. It is very similar, almost identical with the male described by Cresson from Cuba as *wilsoni*. The most notable difference is that the posterior, marginal, silvery pubescent band of the first tergum is thin so that the integument beneath is visible; Cuban specimens have this band dense, so that the integument is not visible.

Dasymutilla militaris subsp. *nigriceps* (Cresson)

Mutilla nigriceps Cresson, 1865, *Proc. ent. Soc. Philad.* **4**: 110, female.
Mutilla Wilsoni Cresson, 1865, *Ibid.* **4**: 112, male, **syn. nov.**
Mutilla Wilsoni Blake, 1871, *Trans. Amer. ent. Soc.* **3**: 240, male.
Mutilla nigriceps Blake, 1871, *Ibid.* **4**: 245, female.
Sphaerophthalma Wilsoni Blake, 1886, *Ibid.* **13**: 232, male.
Sphaerophthalma nigriceps Blake, 1886, *Ibid.* **13**: 238, female.
Mutilla fiorentinii Dalle Torre, 1897, *Cat. Hymen.* **8**: 40, female.
Mutilla wilsoni Dalle Torre, 1897, *Ibid.* **8**: 98, male.
Mutilla (*Ephuta*) *nigriceps* André, 1898, *Ann. Soc. ent. Fr.* **67**: 53, male.
Mutilla nigriceps Fox, 1900, *Ent. News* **11**: 401, female.
Mutilla Wilsoni Fox, 1900, *Ibid.* **11**: 401, male.
Ephuta (*Ephuta*) *nigriceps* André, 1903, *Genera Insectorum* **11**: 62, female.
Ephuta (*Ephuta*) *Wilsoni* André, 1903, *Ibid.* **11**: 65, male.
Dasymutilla nigriceps Mickel, 1928, *Psyche, Camb.* **35**: 18, female.
Dasymutilla wilsoni Mickel, 1928, *Ibid.* **35**: 19, male.
Dasymutilla militaris Mickel, 1937, *Rev. ent., Rio de J.* **7**: 190, female.

Type ♀ (*nigriceps*), Cuba, in collection of American Entomological Society, Philadelphia.

Type ♂ (*wilsoni*), CUBA, in collection of American Entomological Society, Philadelphia.

There can no longer be any doubt that *wilsoni* is the male counterpart of *nigriceps*. The discovery of the male of *militaris* in Jamaica, which is only subspecifically different from *wilsoni*, and the slight differences between the females of *militaris* and *nigriceps*, which can be no more than subspecific, leads to the recognition of *militaris* as the specific name with the type subspecies *militaris* from Jamaica and the subspecies *nigriceps* from Cuba.

The Jamaican and Cuban subspecies may be separated by the following couplets :

Females

Second abdominal tergum with a posterior marginal band of silvery pubescence subinterrupted medially by an indistinct spot of black pubescence subsp. **nigriceps** (Cresson)

Second abdominal tergum with a posterior marginal band of silvery pubescence definitely interrupted medially by a distinct spot of black pubescence subsp. **militaris** (Smith)

Males

First abdominal tergum with a posterior marginal band of dense, silvery pubescence . . . . . subsp. **nigriceps** (Cresson)

First abdominal tergum with a posterior marginal band of thin, silvery pubescence . . . . . subsp. **militaris** (Smith)

Specimens examined (subsp. *nigriceps*) : 1 ♀, CUBA : Cayamas, 27.v (*E. A. Schwarz*) ; 1 ♂, Cayamas, 6.v (*E. A. Schwarz*) ; 2 ♀, Sierra Bonilla, Taparte, Prov. Habana, xi.1928 ; 1 ♀, Sierra Bonilla, Prov. Habana, 7.vii.1929 ; 1 ♀, Santiago de Cuba ; 1 ♀, Las Calabazas, Holguin, i.1933 (*G. C. Aguayo*) ; 1 ♀, Holguin ; 1 ♂, Soledad, Cienfuegos, i–ii.1927 (*C. T. and B. B. Brues*) ; 1 ♂, Soledad, 16.ii.1925 (*J. G. M.*) ; 2 ♂, Limones Seboruco, Soledad, Cienfuegos, 13.ix.1930 (*Richard Dow*) ; 4 ♀, Guantanamo ; 6 ♀ (no data).

Timulla (*Timulla*) *trimaculosa* Mickel

Timulla (*Timulla*) *trimaculosa* Mickel, 1938, *Trans. R. ent. Soc. Lond.* **87** : 665, female.

Holotype ♀, Cat. No. 52158, U.S. National Museum, Jamaica.

The male heretofore undescribed is as follows :

Male.—Head, thorax and legs, entirely black ; abdomen entirely fulvous, except the tip of the last segment fuscous ; head, thorax and legs clothed with pale pubescence, thick and appressed on the front, posterior portion of vertex, genae, posterior margin of pronotum, elevated areas of mesopleura and anterior half of dorsal surface of pronotum, sparse and erect elsewhere, except the mesonotum and anterior median area of scutellum with suberect, black hairs ; abdomen beneath clothed with sparse, pale pubescence, the terga clothed with sparse, fulvous hairs ; mandibles excised beneath ; clypeus transversely concave, glabrous and impunctate, except the median, anterior margin with close, small punctures and erect hairs, and the elevated, posterior, dorsal surface with close, median punctures and thick, long, pale hairs, the elevated, posterior margin of the glabrous area, arcuate ; scape bicarinate beneath, somewhat dilated and flattened distally, the posterior carina more prominent and sharp than the anterior one ; antennal scrobes carinate above ; ocelli moderate in size, the distance between the eye margins and the lateral ocelli about two and one-fourth times the diameter of the latter ; parapsidal furrows distinct on the posterior two-thirds of the mesonotum ; scutellum gibbose ; enclosed area of propodeum long, the sides subparallel and weakly sinuate, only very slightly elevated at the posterior tip, forming a weak tubercle ; tegulae smooth, polished, the anterior and inner margins, and posterior, inner quadrant with pale pubescence ; second tergum almost impunctate on the disk, with moderate, distinct punctures at the sides and posterior submarginal area ; median, impunctate

area of last tergum terminating at the apex of an inverted V-shaped carina separating the dorsal and posterior faces of the tergum, the posterior face perpendicular, triangular in outline and slightly concave; posterior margin of the last tergum strongly, roundly emarginate medially; first sternum with median, longitudinal carina on the anterior two-thirds; second sternum with very sparse, moderate punctures; sterna six and seven with a pair of obscure postero-lateral tubercles; last sternum with a pair of prominent, lateral ridges on the anterior half, each of the ridges terminating in a conspicuous tooth; calcaria pale; cell second $R_1 + R_2$ distinctly truncate distally; cell R_5 receiving vein M_{3+4} slightly before the middle; cell R_4 receiving vein M_2 slightly beyond the middle. Length, 11 mm.

Allotype ♂, West Indies: Washington Boulevard, St. Andrew, Jamaica, 7.xii.1958 (*T. H. Farr*), taken with a female in his grasp, in collection of Science Museum, Institute of Jamaica.

Specimens examined: 1 ♀, same data as allotype above and mounted on same pin; 1 ♀, Rio Cobre Gorge, St. Catherine, Jamaica, 13.xii.1958 (*T. H. Farr*); 1 ♀, Rio Cobre Gorge, St. Catherine, Jamaica, 16.x.1957 (*T. H. Farr*).

The male is related to *proclivis* Mickel (1938, *Trans. R. ent. Soc. Lond.* **87**: 565), differing principally in the weak tubercle at the tip of the enclosed area of the propodeum, and the less dilated scape; also the allotype of *trimaculosa* has the last abdominal segment fuscous posteriorly, while the holotype of *proclivis* has the same segment fulvous throughout.

The taxonomic relationship of the male of *trimaculosa* with *proclivis*, and of the female of *trimaculosa* with *colombiana* (1938, *Trans. R. ent. Soc. Lond.* **87**: 666) seems to indicate that probably *proclivis* and *colombiana* are the two sexes of the same species.

Book Notice

University of California Publications in Entomology. Vol. 17, No. 2. A revision of the mites of the family Spinturnicidae (Acarina). By A. Rudnick. Pp. 157–284, illust. 8vo. Berkeley and Los Angeles. Price $2.50.

Vol. 17, No. 3. A taxonomic and biological study of the genus *Xyela* Dalman in North America. By D. J. Burdick. Pp. 285–356, illust. 8vo. Berkeley and Los Angeles. Price $1.50.

The above works are recent additions to the University of California Publications in Entomology. The first work is a complete revision of the Spinturnicidae. It deals with the thirty-seven species that are considered to be valid, and the seven genera to which they belong; of these three are new. Five species of the genus *Spinturnix* and the male of *Ancystropus zeleborii* Kolenati are described for the first time. The work contains an historical review and gives details of the life cycle, habits and habitats of the Spinturnicidae, with a classified list of hosts. There is a section on systematics in which their nomenclature is discussed; a number of names have been reduced to synonyms, lists of *species inquirendae*, *nomina nuda*, and species incorrectly placed in the Spinturnicidae are presented, and a list of species names invalidated as a result of Opinion 128 of the International Commission on Zoological Nomenclature (1936) is given.

The second work was undertaken to add to the knowledge of the biology and to present a better understanding of the taxonomic positions of the species of *Xyela* in the light of modern concepts. It contains an historical review of the genus, an evaluation of its taxonomic characters and sections on methods and techniques, external morphology, phylogeny and geographical distribution, biology, and parasites. There is a section on taxonomy which contains a key to the North American species and which includes descriptions of sixteen species of which nine are new.

THE USE OF THE LARVAL CUTICULAR PATTERN IN CLASSIFYING THE *SIMULIUM NEAVEI* ROUBAUD COMPLEX (DIPTERA : SIMULIIDAE)

By D. J. Lewis[1]

(*Scientific Staff, Medical Research Council*)

The study of the complex began in May, 1911, with the discovery of *Simulium neavei* Roubaud on the Yala River in Kenya, and was later stimulated by the discovery that at least one species transmits human onchocerciasis. McMahon's finding of the early stages on crabs in 1950 opened the way to an adequate study of the complex, and Freeman and De Meillon (1953) published a valuable comprehensive account of the existing knowledge. They were handicapped, however, by the difficulty of obtaining larvae, pupae and males with which to establish the identity of the biting females found in various parts of Africa. This difficulty remains, but several recent developments make it advisable to reconsider the classification of the complex. Grenier and Mouchet (1958, 1959*a*, *b*) have discovered a new species, *S. ovazzae*, described it in detail, and revealed a new taxonomic character for the complex, a microscopic pattern on the larval cuticle. I have studied the forms at Amani in Tanganyika (Lewis, 1960*a*) and obtained additional specimens of two members of the complex from their type areas in Nyasaland.

In this paper the better known members of the complex are placed in three groups according to their larval cuticular pattern, some characters of all species are mentioned, and a new name is given to one of the Kenya forms. A complete synonymy can be found in the work of Freeman and De Meillon (1953).

The method of grouping proposed below seems to aid identification, but its validity can only be verified when, in the course of time, it is possible to examine the early stages and males of members of the complex from many of the areas where they are at present unknown or only represented by females. The collection of sufficient material is bound to take many years. In some areas there may be no onchocerciasis to make the work urgent, or there may be more than one species in a locality, where weeks can be spent in locating the crabs and collecting enough specimens of the simuliids to associate larvae with pupae and pupae with adults and to study the degree of variation.

The larval structure formerly known as the submentum is here called the hypostomium for reasons explained by Crosskey (1960) who has discussed the larval characters of the *S. neavei* complex.

The cuticular pattern of a larva can easily be seen if the ventral wall of the body is slit longitudinally, most of the internal organs scraped away, and the integument mounted flat in a chloral-gum medium or in water.

Grouping of the known species

Several of the characters used hitherto for identifying members of the complex have been found to vary somewhat within certain species. It is hoped, however, that the cuticular pattern of the larvae, which has not been reported in other simuliids, will prove to be generally useful for identification by dividing the species into groups as shown in the following list and key.

[1] Care of British Museum (Natural History); a grant from the Colonial Development and Welfare Fund, awarded by the Colonial Office, helped to finance this work.

Group 1 (linear pattern): *S. neavei* Roubaud. Group 2 (lizard-skin pattern): *S. nyasalandicum* De Meillon, *S. woodi* De Meillon. Group 3 (pebble pattern): *S. hightoni* sp. n., *S. ovazzae* Grenier and Mouchet, *S.* sp. (Kenya "*woodi*").

1 Larval body-cuticle with pattern of fine lines (fig. 1, *A*), claw-tooth of female small or absent . . . . . **neavei** Roubaud
– Larval body-cuticle with pattern of minute platelets (fig. 1, *D*, *I–K*) . . 2
2 Small platelets of larval cuticle connected, angular (lizard-skin pattern) (fig. 1, *D*) 3
– Small platelets of larval cuticle discrete, elliptical (fig. 1, *I–K*) 5
3 Claw-teeth of female large, abdomen with dark band . . . **woodi** De Meillon
– Claw-teeth of female small, abdomen without dark band 4
4 Larval hypostomium with straight sides . **nyasalandicum** De Meillon (typical form)
– Larval hypostomium with convex sides . **nyasalandicum** De Meillon (Amani form)
5 Platelets of larval cuticle delicate (fig. 1, *K*); style of male less than half as long as coxite, ventral plate with narrow apical emargination (Freeman and De Meillon, 1953, fig. 34) . . . . . **hightoni** sp. n.
– Platelets of larval cuticle clearly defined (fig. 1, *I*, *J*); style of male more than half as long as coxite, ventral plate with broad apical emargination . . 6
6 Second main branch of pupal gill about 15 times as long as wide **ovazzae** Grenier and Mouchet
– Second main branch of pupal gill about 2·5 times as long as wide sp. (Kenya "*woodi*")

Simulium neavei Roubaud

Simulium neavei Freeman and De Meillon, 1953; Grenier and Mouchet, 1959*b* (larval integument); McMahon, 1957.

Cocoon (Bufumbo, Uganda).—Smooth (so that the pupa is easily extracted), robust (does not collapse readily after being mounted in drop of chloral-gum medium on a slide), with or without coarse dark threads, and with more or less definite dark rim.

Larva (Bufumbo).—The clypeal pattern is very like that of *S. ovazzae*, and the postgenal cleft is about the same size as the hypostomium. The lines on the cuticle, which Grenier and Mouchet (1959*b*) photographed by phase-contrast illumination, are shown in figure 1*A* as seen by ordinary illumination.

Habits.—It is well known that the larvae and pupae occur externally on crabs. Near Yakusu in the Belgian Congo larvae are often found on the leg bases (Browne, 1960). The females often bite man.

Distribution (Freeman and De Meillon, 1953).—Belgian Congo (inspection of more larvae is desirable). Kenya. Uganda.

Simulium nyasalandicum De Meillon (typical form)

Simulium nyasalandicum De Meillon, 1930; Freeman and De Meillon, 1953 (in part).

Male.—Terminalia: style more than half as long as coxite and shaped like that of *S. neavei*, ventral plate with broad posterior notches in *S. neavei*, convex dorsally in lateral view.

Pupa.—Very like that of *S. neavei*; gill 2·3 mm. long, second main branch about two to three times as long as wide; 4 small dorsal hooks on each side of second abdominal segment.

Cocoon.—Rather rough (so that the pupa is not easily extracted), soft (collapses after being mounted in a drop of chloral-gum on a slide), without coarse dark threads or dark rim.

Larva.—Clypeal pattern rather like that of *S. ovazzae* but variable. Postgenal cleft about same size as hypostomium and postgenal ridge slightly longer. Hypostomium (fig. 1, *C*), with straight sides and a few dark lines anteriorly; pointed lateral serrations occupying about half the length of the sides, hypostomial teeth 5 or 6 in each row. Cuticle of thorax and abdomen covered with minute platelets (fig. 1, *D*) touching each other and angular.

Habits.—Larvae and pupae occur externally on crabs; females of the original series may have been caught on man or domestic animals (Freeman and De Meillon, 1953) but this form is not known to be very troublesome.

Specimens examined.—Nyasaland: Mlanje, 1914, cotypes; i.1960, 1 ♀ and 1 ♂ bred, 1 ♂ dissected from pupa, 6 pupae, 30 larvae. It is presumed that only one species of the complex exists in this locality and that all the 1960 specimens are *S. nyasalandicum*, although none was found biting, because the pupal gills are remarkably uniform in shape and the respiratory histoblasts, seen in one larva, resemble the pupal gills.

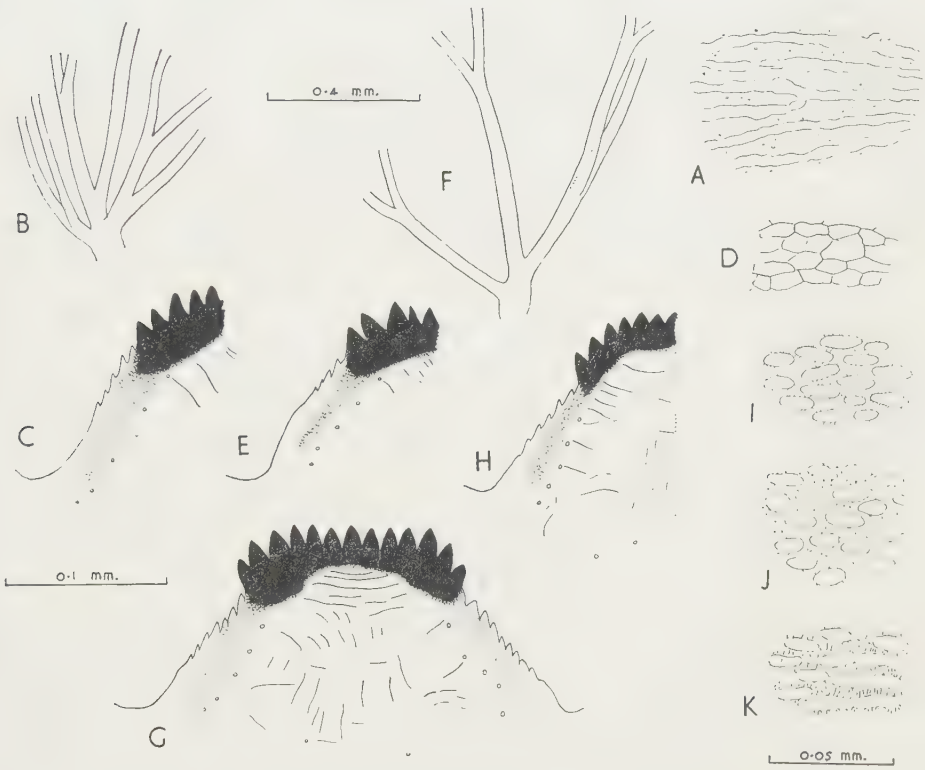

Fig. 1.—(*A*) *Simulium neavei* Roubaud, larva from Bufumbo, cuticular pattern. (*B–D*) *S. nyasalandicum* De Meillon from Mlanje: *B*, pupa, gill; *C*, larva, hypostomium; *D*, larva, cuticular pattern. (*E*) *S. nyasalandicum* from Amani, larva, hypostomium. (*F–H*) *S. woodi* De Meillon: *F*, pupa from Amani, gill; *G*, larva from Magombe, hypostomium; *H*, larva from Amani, hypostomium. (*I*) *S. ovazzae* Grenier and Mouchet, larva from Bamindjing, cuticular pattern. (*J*) *S.* sp. (Kenya "*woodi*"), larva from Kisumu area, cuticular pattern. (*K*) *S. hightoni* sp. n., larva from R. Kagera, cuticular pattern.

Simulium nyasalandicum De Meillon (Amani form)

This was described by Lewis (1960*a*) as the Amani unbanded form.

Female.—Resembles the type form.

Habits.—Larvae and pupae found externally on crabs; the females are not known to bite man but one has been taken on a mule (Lewis, 1960*a*).

This simuliid differs from typical *S. nyasalandicum* in the shape of the larval hypostomium (fig. 1*E*) and the biting habits of the female. Further study should show whether it is a subspecies.

Distribution.—Tanganyika: Amani.

Simulium woodi De Meillon

Simulium woodi Freeman and De Meillon, 1953 (in part, Nyasaland specimens).
Simulium sp., Amani banded form, Lewis, 1960*a*.

Female.—As in description by Freeman and De Meillon (1953). Mandibles, maxillae and cibarium as in *S. neavei* (2 examined).

Cocoon and larva.—As in *S. nyasalandicum*.

Larva.—Apparently similar to that of *S. nyasalandicum*.

Habits.—One larva has been found on the carapace of a crab at Magombe, and many at Amani (Lewis, 1960*b*) ; the females bite man at both places.

Specimens examined.—Nyasaland : Cholo area, 1917, 1 ♀, 1920, 2 ♀. Magombe (Cholo area), 17.i.1960 (*N. Kadunga*), 1 ♀ ; 19.i.1960 (*D. J. L.*), 1 larva (taken at the type locality and presumed to be this species).

Distribution.—Nyasaland : Magombe. Tanganyika : Amani.

Simulium ovazzae Grenier and Mouchet

Simulium sp. Grenier and Mouchet, 1958.
Simulium ovazzae Grenier and Mouchet, 1959*a*, *b*.

The cocoon, described by Grenier and Mouchet, evidently differs from that of the related *S. o. goinyi*.

The cuticular pattern of the larva, drawn from a specimen presented by Dr. Grenier, is shown in figure 1, *I*, for comparison with those of other species.

Habits.—The larvae are found on crabs or in their branchial orifices ; the females are not known to bite man.

Distribution.—Cameroon Republic : Bamindjing. French Equatorial Africa : M'Pasa (near Brazzaville).

Simulium sp. (Kenya "*woodi*")

Simulium woodi Freeman and De Meillon, 1953 (in part, Kenya specimens).
Simulium woodi McMahon, 1957 ; Grenier and Mouchet, 1959*b*.

The larval cuticular pattern of this species is shown in figure 1, *J*.

Although no pupae or males of the Nyasaland *S. woodi* have been obtained, the hypostomial markings and cuticular pattern of a larva from the type locality of *S. woodi* suggest that the Kenya form hitherto known by this name is different. This opinion is supported by the absence of the Kenya form at Amani in the eastern part of the intervening territory of Tanganyika. It seems likely that the Kenya "*woodi*" will prove to be a subspecies of *S. ovazzae* which it resembles in several respects (Grenier and Mouchet, 1959*b*). It seems advisable, however, to defer a decision until males and pupae of *S. woodi* can be obtained from the type locality or elsewhere in Nyasaland.

Habits.—The larvae occur in the branchial orifice of crabs, and the females are not known to bite man.

Distribution.—Kenya : various localities in Nyanza Province.

Simulium hightoni sp. n.

Simulium nyasalandicum Freeman and De Meillon, 1953 (in part, Kenya specimens).
Simulium nyasalandicum McMahon, 1957.

Cocoon.—Threads all pale (McMahon, 1957, Kenya), or pale and dark (R. Kagera).

Larva.—The cuticular pattern of a Uganda specimen is shown in figure 1, *K*.

Habits.—The larvae live externally on crabs, and the females rarely bite man.

The examination of early stages and males from the type area of *S. nyasalandicum* indicates that the Kenya "*nyasalandicum*" is a different species, which is now named after Mr. R. B. Highton in accordance with a suggestion by Mr. McMahon.

A type female, from Nzoia river, Kenya (20.xii.1950) has been selected from the material in the British Museum (Nat. Hist.).

Distribution.—Uganda : R. Kagera. Kenya : various parts of Nyanza Province.

Specimens of the S. neavei *complex which can not yet be identified*

The *S. neavei* complex is known to exist in the following parts of Africa from which neither early stages nor males are available to indicate the species with certainty. Except where otherwise shown, the areas are recorded by Freeman and De Meillon (1953) or De Meillion (1957). Ethiopia : Jimma region (Freeman and De Meillon, 1953 ; Grenier and Mouchet, 1959*b*). Northern Rhodesia. Nyasaland : Namwera Hills (Berner and Carr, 1953) ; Nchisi Mountain, xi.1958 (*R. C. H. Sweeney*), 3 ♀ in British Museum (Nat. Hist.), probably *S. woodi*. Tanganyika : Kidodi, Mahenge (probably) and Ubena (Lewis, 1960*b*) ; Njombe. Uganda : *S. woodi* has been reported, its early stages on crabs or in their branchial orifice, by Barnley and Prentice (1958, discussion) and mentioned by Grenier and Mouchet (1958 : 970, 972, 975) but, in the light of present knowledge, it is desirable that this record should be confirmed by a description of the larval cuticular pattern and other features.

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References

Barnley, G. R. and Prentice, M. A., 1958, *Simulium neavei* in Uganda. *E. Afr. med. J.* **35** : 475–85.

Berner, L. and Carr, A. F., 1953, Entomological report. *In* Sir William Halcrow and Partners, *The Shire Valley Project*, **2**. Government of Nyasaland.

Browne, S. G., 1960, Observations on *Simulium neavei* Roubaud, with special reference to a focus of onchocerciasis in the Belgian Congo. *Bull. ent. Res.* **51** : 9–15.

Crosskey, R. W., 1960, A taxonomic study of the larvae of West African Simuliidae (Diptera : Nematocera). *Bull. Brit. Mus. (Nat. Hist.)* **10** : 1–74.

De Meillon, B., 1930, On the Ethiopian Simuliidae. *Bull. ent. Res.* **21** : 185–200.

—— 1957, Bionomics of the vectors of onchocerciasis in the Ethiopian geographical region. *Bull. Wld. Hlth. Org.* **16** : 509–22.

Freeman, P. and De Meillon, B., 1953, *Simuliidae of the Ethiopian Region*. London : British Museum (Nat. Hist.).

Grenier, P. and Mouchet, J., 1958, Première capture au Cameroun d'une Simulie du complexe *neavei*. *Bull. Soc. Path. exot.* **51** : 968.80.

—— —— 1959*a*, *S. ovazzae* n. sp. (Diptera, Simuliidae) espèce nouvelle du groupe *neavei*. *C.R. Acad. Sci., Paris* **248** : 2694–5.

—— —— 1959*b*, Note complèmentaire sur la morphologie et la biologie de *S. ovazzae* Grenier et Mouchet. *Bull. Soc. Path. exot.* **52** : 373–85.

Lewis, D. J., 1960*a*, The *Simulium neavei* Roubaud complex (Diptera : Simuliidae) at Amani in Tanganyika. *Proc. R. ent. Soc. Lond.* (B) **29** : 7–10.

—— 1960*b*, Observations on the *Simulium neavei* complex at Amani in Tanganyika. *Bull. ent. Res.* **51** : 95–113.

McMahon, H. P., 1957, Notes on the *Simulium neavei* group of Simuliidae with particular reference to *S. nyasalandicum* and *S. woodi*. *Ibid.* **48** : 607–17.

SECONDARY SEXUAL CHARACTERS IN ADULT *ALPHITOPHAGUS BIFASCIATUS* SAY (COLEOPTERA : TENEBRIONIDAE)

By Gordon Surtees

(Agricultural Research Council, Pest Infestation Laboratory, Slough, Bucks.)

The adult males of *Alphitophagus bifasciatus* Say may be distinguished by the peculiar external morphology of the head. In the female, the labrum is sub-rectangular and the fronto-clypeal region is rounded with fused, indistinct sutures. The interocular region is rounded anteriorly and is without any irregularities. Viewed laterally the

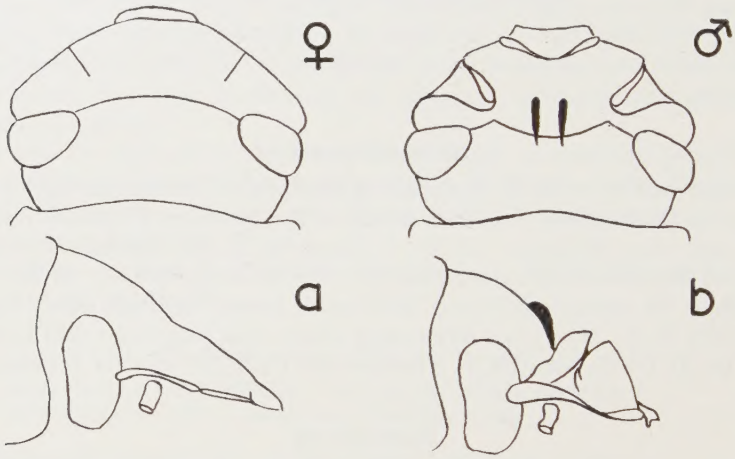

Fig. 1.—*Alphitophagus bifasciatus* Say : dorsal and lateral views of adult head ; (*a*) female, (*b*) male.

epicranium and fronto-clypeus appear as smooth rounded surfaces with the lateral margins of the latter region thickened, posteriorly obscuring 2–3 eye facets (fig. 1*a*).

When the male head is viewed dorsally, the labrum is seen to have an excavated anterior margin. The fronto-clypeus is similarly excavated and has thickened anterior angles. Arising at a point approximate to the fronto-clypeal sutures in the female are two wings. The anterior part of the epicranium is deeply concave and contains two elongate, black, shining ridges running anterio-posteriorly in the inter-ocular region. Viewed laterally the fronto-clypeal region is obscured by the wings and the margins are more thickened than in the female (fig. 1*b*).

In both sexes the antennae arise from beneath the lateral extensions of the fronto-clypeus immediately anterior to the eyes.

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